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PETER AIMING CHENG  
EPIDURAL NEEDLE

2,922,420

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2 Sheets-Sheet 1

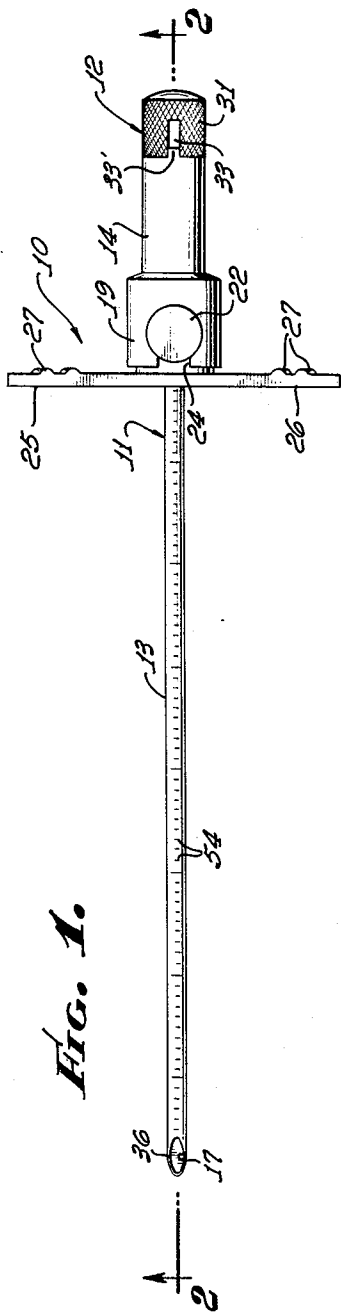


Fig. 1.

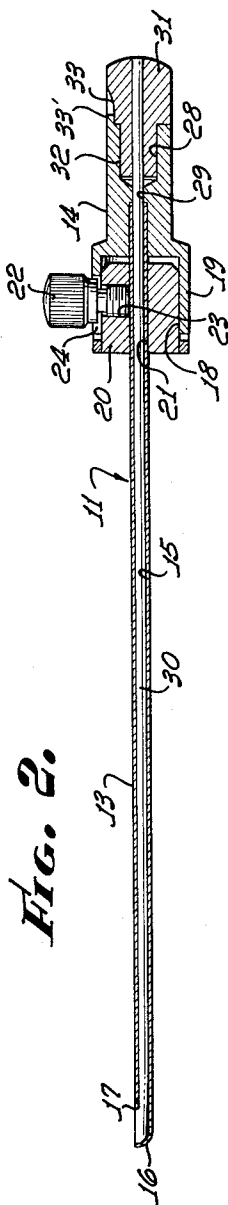


Fig. 2.

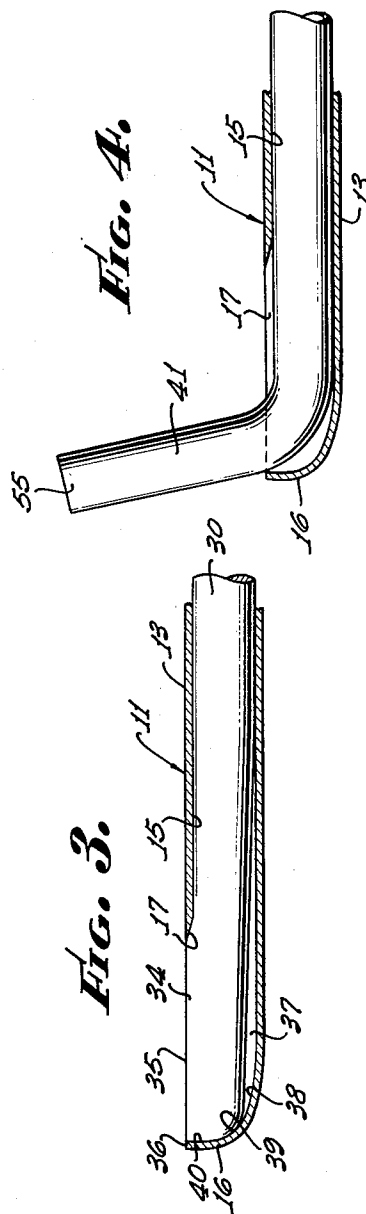


Fig. 3.

Fig. 4.

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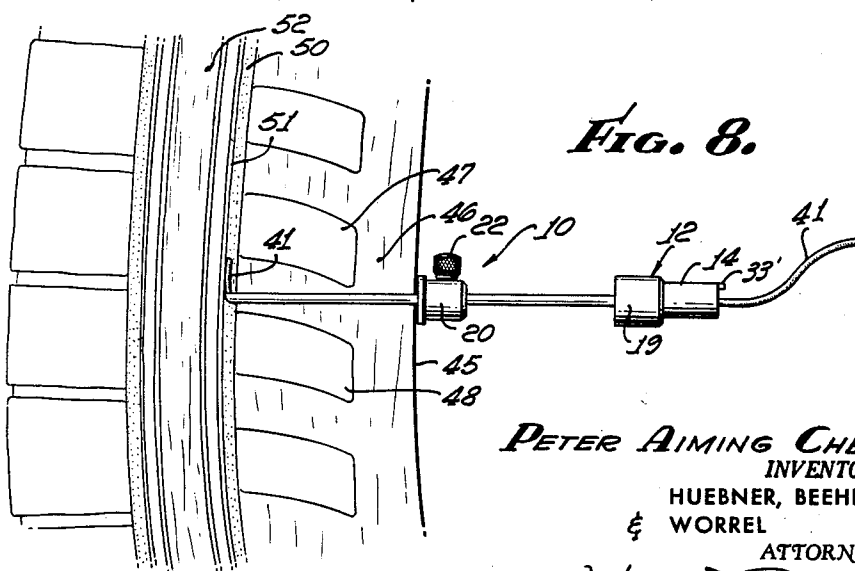
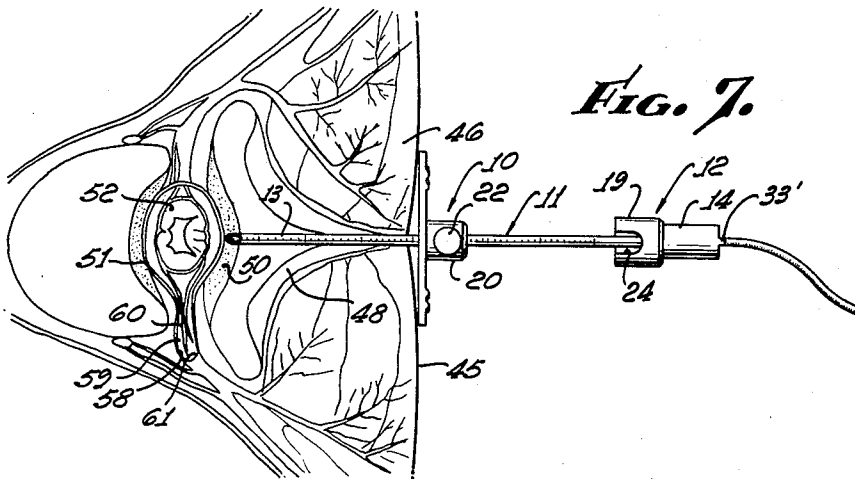
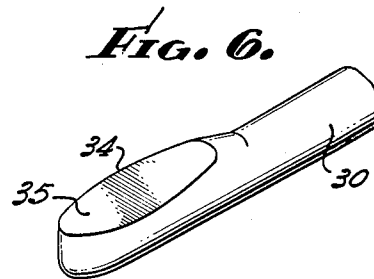
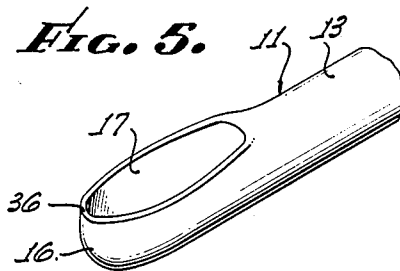
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2,922,420

## EPIDURAL NEEDLE

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8 Claims. (Cl. 128—221)

The invention relates to surgical instruments and has special reference to instruments used for the purpose of administering anesthetic through use of a penetrating needle followed by the employment of a catheter. More particularly the invention herein disclosed pertains to a needle mechanism used to penetrate the spine which after penetration serves as a means for guiding a small catheter into proper position by means of which anesthetic fluid is introduced into the spinal epidural space at a desired location.

For a considerable number of years surgical technique has employed an anesthetic procedure commonly termed a spinal subarachnoid block. To administer anesthetic in accordance with this technique the accepted practice has been to puncture the spinal subarachnoid through to the spinal canal and there extract a small portion of the spinal fluid, mix it with a very carefully measured amount of selected anesthetic, and reinject the mixture into the spinal canal. While this technique has been a tremendous benefit in surgical operations because of the fact that it is capable of anesthetizing portions only of the lower section of the body where surgery is to take place without the necessity of rendering the patient unconscious, for the reason if too much anesthetic fluid is injected into the spinal canal, it may cause high spinal anesthesia and develop spinal shock. Spinal anesthesia has more complications than epidural anesthesia.

Subsequently there was developed an anesthesia technique known as epidural anesthesia. This technique makes use of a space surrounding the spinal canal but separate from the spinal dura. Administration of anesthesia into this portion of the spine has material advantages in that the amount of anesthetic fluid need not be calculated to such a fine degree. It can be used for anesthesia of neck, upper extremity, chest, abdomen and lower extremities. Also the epidural anesthetic technique has been found to be one virtually free from danger and complications. Moreover, because the epidural cavity extends to a location well below the foramen magnum, it blocks only the foramy nerves, not the motor nerves.

Although these very marked advantages in employment of epidural anesthesia have been recognized for a considerable time, this technique has not been widely employed because of a lack of adequate instruments. If epidural anesthesia is to be used, extreme care must be taken not to penetrate into the spinal dura (and subarachnoid). Where sharp needles have been used, and this has been the customary procedure up to this time, even the most skillful handling cannot avoid an inadvertent penetration past the epidural space and into the spinal subarachnoid space sometimes. In fact the epidural space is such a relatively small space that it can be located by use of instruments heretofore available only with exercise of the most extreme care. Obviously, should the spinal dura and subarachnoid be inadvertently pierced and a quantity of anesthetic administered on the assumption that it would be reaching only the epidural space, extremely serious consequences would unquestionably result. Hence,

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for lack of proper instruments this highly desirable and advantageous anesthetic technique has not been practiced.

It is therefore among the objects of the invention to provide a new and improved epidural anesthetic technique with the assistance of newly developed instrumentation which is more greatly effective and more easily administered than has heretofore been possible.

Another object of the invention is to provide a new and non-critical type of epidural anesthesia technique which makes it possible to administer the anesthetic with relatively great safety and without the necessity of as great a degree of skill as has heretofore been needed.

Still another object of the invention is to provide a new and improved epidural needle device by means of which a hollow needle can be inserted into the epidural space without fear of puncturing the dura and hence without fear of endangering the patient's life.

Still another object of the invention is to provide a new and improved needle device by means of which a hollow needle can be effectively and safely inserted into the epidural space and once in position be capable of facilitating the insertion of a catheter oriented at desired level and without likelihood of inducing a kink in the catheter however small the catheter may be, it being further an object of the invention to so construct the needle device that the degree of penetration can be set off on the exterior portion of the needle by use of such suitable handholds as will in themselves facilitate manipulation of the needle both during insertion and removal.

The objects of the invention also contemplate so constructing the new and improved epidural needle device that it may be capable of making a clean entry into the epidural space without likelihood of entering any tissue or other portions of the anatomy and which after insertion can be partially disassembled by the removal of a blocking and stiffening insert stylet whereupon a conventional syringe may be conveniently applied to the needle for the commonly accepted purposes.

With these and other objects in view, the invention consists in the construction, arrangement and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

Figure 1 is an elevational view of the needle device in assembled condition.

Figure 2 is a longitudinal sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a fragmentary enlarged longitudinal sectional view of the blunt end of the needle device.

Figure 4 is a longitudinal sectional view of the blunt end of the needle device after removal of the stylet and insertion of a catheter tube.

Figure 5 is a perspective view of the blunt end of the needle device.

Figure 6 is a perspective view of the end of the stylet adapted to be inserted into the needle.

Figure 7 is a cross-sectional view of the spinal region at more or less the mid-portion of the back showing application of the needle assembly thereto.

Figure 8 is a longitudinal sectional view of the same portion of the anatomy illustrated in Figure 7 showing the needle position during administration of an anesthetic fluid.

In an embodiment of the invention chosen for the purpose of illustration an epidural needle device 10 is shown as comprising in the main two parts, namely, a hollow needle assembly 11 and a stylet assembly 12. The needle assembly comprises essentially a hollow shaft 13 at one end of which is a bushing 14 within which the shaft is firmly positioned. The needle shaft has an in-

terior central passage 15 and at its free end terminates in a blunt point 16. Adjacent the point and in the wall of the shaft is an ellipsoidal opening 17 which faces in a lateral direction.

At the end of the bushing facing the needle shaft there is provided a recess 18 defined by an annular flange 19. Slidably mounted on the recess is a collar 20 or flange. In the collar 20 is a bore 21 which provides a smooth sliding fit of the collar upon the needle shaft throughout its length. To secure the collar upon the shaft in any selected position there is provided a tightening screw 22 which is threadedly engaged in a hole 23 in the collar. In order that the collar may be received within the recess 18 which is designed to fit, there is provided a notch 24 in the flange 19 into which the screw can slide.

Also mounted upon the collar is a pair of finger holds 25 and 26 on which are projections 27 to assist the technician in securing a firm grasp upon the instrument when the collar is tightened in position.

On the opposite end of the bushing 14 is a slightly tapered pocket 28 which communicates through a passage 29 with the central passage 15 of the needle shaft.

The stylet assembly previously made reference to comprises a rod or shaft 30 at one end of which is a handle 31. The handle is equipped with a tapered portion 32 having a snug fit within the pocket 28. A notch 33 may be provided on the head for the purpose of aligning the rod in proper position. Such alignment is made necessary by reason of there being a projection 34 at the opposite end of the rod 30, the projection having an elliptical shape precisely conforming to the shape and size of the ellipsoidal opening 17. From an examination of Figure 3 it will be noted that the projection 34 is adapted to be received in the ellipsoidal opening to a point where an outer face 35 of the projection is precisely flush with a rim 36 around the ellipsoidal opening. At the end of the rod occupied by the projection 34 the rod will be slightly smaller in breadth so as to enable the projection to pass freely within the central passage 15. By providing a slight spring in the rod biased toward the projection, the projection will be forced into the ellipsoidal opening, in which event there may be a space 37 remaining but this will be completely closed. The direction in which the projection faces can always be determined by the alignment of the notch 33.

It is also important to note that the inner face of the blunt point 16 is sloped in a particular fashion, namely, that a gentle slope 38 is provided where the slope becomes tangent to the inside wall of the central passage. This gentle slope progressively increases in steepness along a line 39 until it is virtually perpendicular to the axis of the needle shaft along a line 40.

The purpose of the sloping line just defined is to direct the emergence of a catheter tube 41 as it is pushed through the central passage 15 and outwardly of the ellipsoidal opening 17.

When the needle is to be employed, the practice is to first give the patient a skin depth anesthetic in the region where the needle will ultimately be inserted. It has been found in practice that the best area to administer the technique is above the third lumbar vertebra where the dura is thick rather than below the third lumbar where the dura is thin and might more easily be inadvertently penetrated. Also above the third lumbar vertebra the space between vertebrae is relatively wide.

After having administered the skin depth anesthetic a regular 15G. sharp needle, not shown, is employed to penetrate through a layer 45 of skin which has been anesthetized, thence through tissue 46 between spinal processes 47 and 48.

The piercing needle is then withdrawn and the blunt needle shaft 13 is inserted into the hole thus formed and the stylet is removed.

It is readily possible for the technician to know precisely when the needle has pierced the ligament structure

and has entered the epidural space 50 by reason of the fact that a negative pressure exists in the epidural space. A droplet of water or anesthetic may be placed upon the outer end of the hollow piercing needle and as soon as the pointed inner end enters the epidural space, the fluid will be sucked through the needle into the epidural space.

During insertion of the blunt needle shaft the parts will have the relationship illustrated in Figures 1, 2, and 3. Because of the presence of a blunt point 16, the needle shaft may be forced with considerable degree of pressure into proper position. This portion of the operation is greatly facilitated by employment of the finger holds 25 and 26. Ordinarily the technician grasps the finger holds between the thumb and forefinger of each hand while resting the back of the rest of the fingers as a guide on the back of the patient to whom the anesthetic is being administered. By thus firmly grasping the finger holds the needle shaft can be pushed into place with the blunt point entering through the ligament structure into the epidural space 50. During this operation even though the needle shaft might be pushed further than necessary, the blunt point will prevent piercing the dura 51 and penetration into the subarachnoid space 52. By reason of the fact that the projection 34 of the stylet closes the ellipsoidal opening 17, no tissue will be dragged into the epidural space 50. Once in place the collar is then loosened and moved to the position illustrated in Figure 8 pressing against the skin 45 and is there again tightened. So the needle will not go further in the epidural space by providing graduations 54 in centimeters and millimeters it can readily be determined how deep the penetration is in any given operation for reinserion of the needle in the same place.

Upon completion of these steps the stylet assembly 12 is withdrawn by loosening the handle 31 and extracting the rod 30 from its position within the shaft 13. For administering anesthetic the catheter tube 41 is then inserted into the bottom of the pocket 28 through the passage 29 and thence through the central passage 15 of the shaft 13. Catheter tubes of conventional size and material can be employed in this fashion. The catheter tube is pushed through the passage 15 until an inner end 55 is directed upwardly by the slopes 38, 39 and 40 until it emerges at a gentle angle through the ellipsoidal opening 17. Guided by a notch-engaging projection 33', the technician will know in just which direction the opening faces. Hence the catheter tube may be inserted upwardly from the inside end of the needle or downwardly depending upon the requirements of the anesthesia problem.

After the catheter tube is in place anesthetic may be injected through the tube following customary and well known procedures. For the administration of an epidural anesthesia of the type herein made reference to quantities of anesthetic fluid ranging from ten cubic centimeters to thirty cubic centimeters may be employed as contrasted with a precisely measured ten millimeter quantity used for spinal blocks within the spinal canal.

The fluid thus administered flows both upwardly and downwardly within the epidural space and the quantity can be increased until a proper anesthetic effect results in the desired regions of the body. The desired condition is facilitated by passage of the fluid through the epidural space and spreads out through the vertebral foramen and blocks the spinal nerve roots (anterior and posterior nerve and spinal ganglion). By having the fluid flow through these regions as is possible by use of the epidural anesthetic technique a very widespread and effective anesthetic effect can be safely produced.

Should it become advisable to remove the needle assembly after insertion of the catheter, the assembly can be reinserted in the same space to exactly the same location guided by the fixed position of the collar previously adjusted, if it is necessary.

It is also possible to employ the pocket 28 as a means

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of attachment for a conventional syringe directly for single injection of epidural anesthesia. In this case a catheter will not be used.

It will be appreciated therefore that there has been herein described a new and improved special anesthetic needle having structural advantages of safety and convenience which makes possible the employment of epidural anesthesia with a dependable degree of safety and in a fashion productive of prompt and rapid administration.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An epidural anesthetic device comprising a needle shaft, a passageway in the shaft having an opening in an axial direction at the outer end and a laterally facing opening in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a blunt point for said shaft, the inside face of said point having a curved slope changing progressively from a portion tangent to the inside wall of the passageway to a portion transverse to the axis at the exterior end, a bushing at the outer end of the needle shaft having an outwardly opening pocket in communication with said central passageway, and a stylet assembly comprising a rod of diameter smaller than said central passageway and initially receivable in said central passageway, a head on the inner end of said rod having an enlargement receivable in said lateral opening, said stylet assembly being removable from the needle shaft after penetration.

2. An epidural anesthetic device comprising a needle shaft, a central passageway therein having an opening in an axial direction at the outer end and a laterally facing opening in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a blunt point for said shaft, the inside face of said point having a curved slope changing progressively from a portion tangent to the inside wall of the passageway to a portion transverse to the axis at the outermost end, a bushing at the outer end of the needle shaft having an outwardly opening pocket in communication with said central passageway, a stylet assembly comprising a rod of diameter smaller than said central passageway and initially receivable in said central passageway, a head on the inner end of said rod having a laterally spring biased enlargement receivable in said lateral opening, and a handle on said stylet temporarily engageable with said bushing, said stylet assembly being removable from the needle shaft after penetration for replacement with a catheter tube.

3. An epidural anesthetic device comprising a needle shaft, a central passageway therein having an opening in an axial direction at the outer end and a laterally facing opening of ellipsoidal shape in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a blunt rounded point for said shaft, the inside face of said point having a compoundly curved slope changing progressively from a gentle rising portion tangent to the inside wall of the passageway to a sharply rising portion transverse to the axis at the outermost end, a bushing at the outer end of the needle shaft and secured thereto, said bushing having an outwardly opening pocket in communication with said central passageway, a stylet assembly comprising a rod of diameter smaller than said central passageway and initially receivable in said central passageway, a head on the inner end of said rod having a flat faced laterally positioned enlargement receivable in said lateral opening, said rod at the area of the enlargement being bent slightly toward the projection and having a breadth less than the

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inside diameter of the passageway whereby to enable sliding of said projection therethrough, a handle on said stylet having a tapered portion temporarily receivable in said pocket, said stylet assembly being removable from the needle shaft after penetration for replacement with a catheter tube.

4. An epidural anesthetic device comprising a needle shaft, a central passageway therein having an opening in an axial direction at the outer end and a laterally facing opening in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a blunt point, the inside face of said point having a curved slope changing progressively from a portion tangent to the inside wall of the passageway to a portion transverse to the axis at the outermost end, a bushing at the outer end of the needle shaft and secured thereto, said bushing having an outwardly opening passage in communication with said central passageway, a stylet assembly comprising a rod temporarily receivable in said passageway in a position blocking said opening and a handle having a tapered portion temporarily receivable in said pocket, and a collar having a sliding fit on said needle shaft, a tightening screw on said collar, and a pair of laterally extending fingerholds on said collar.

5. An epidural anesthetic device comprising a needle shaft, a central passageway therein having an opening in an axial direction at the outer end and a laterally facing opening in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a blunt point, the inside face of said inner end having a curved slope changing progressively from a portion tangent to the inside wall of the passageway to a sharply rising portion transverse to the axis at the outermost end, a bushing at the outer end of the needle shaft and secured thereto, said bushing having an outwardly opening pocket in communication with said central passageway, a stylet assembly comprising a rod temporarily receivable in said passageway in a position blocking said opening and a handle having a portion temporarily receivable in said pocket, a recess in said head on the end thereof opposite said pocket and surrounding the needle shaft, and a collar having a sliding fit on said needle shaft and adapted to be received in said recess, a tightening screw on said collar, and a pair of laterally extending fingerholds on said collar.

6. An epidural anesthetic device comprising a needle shaft, a central passageway therein opening in an axial direction at the outer end and a laterally facing ellipsoidal opening in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a hollow blunt rounded point for said shaft, the inside face of said point having a compoundly curved slope changing progressively from a gentle rising portion tangent to the inside wall of the passageway to a sharply rising portion transverse to the axis at the outermost end, a bushing at the outer end of the needle shaft and secured thereto, said bushing having an outwardly opening frusto-conical pocket in communication with said central passageway and a projection extending therefrom in alignment with said ellipsoidal opening, a stylet assembly comprising a rod temporarily receivable in said passageway, a head on the rod receivable in said ellipsoidal opening, a handle having a tapered portion temporarily receivable in said pocket, and a notch on the handle in alignment with said head adapted to receive said projection thereby to position said stylet assembly, means forming an annular cylindrical recess in said bushing on the end thereof opposite said pocket and surrounding the needle shaft, lineally spaced markings on the exterior of the shaft, and a collar having a sliding fit on said needle shaft, a radially extending tightening screw on said collar, a pair of laterally extending fingerholds on said collar, and means forming an open end slot in the wall of the recess receptive of the screw when the collar is received in said recess.

7. An anesthetic device comprising a needle shaft, a

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longitudinally extending passageway in the shaft, a blunt rounded point at one end of said needle shaft, said passageway having a laterally facing opening at said one end adjacent the point and an opening at the opposite end, a bushing at said opposite end having an outwardly opening pocket in communication with said passageway, and a stylet assembly comprising a rod of diameter smaller than said passageway and initially receivable therein, said rod having an end in position closing said laterally facing opening when the rod lies within said passageway, said stylet assembly being removable from the needle shaft after penetration.

8. An epidural anesthetic device comprising a needle shaft, a central passageway therein having an opening in an axial direction at the outer end and a laterally facing opening in the wall of the shaft at the innermost end, a portion of the inner end of the shaft forming a blunt point, a bushing at the outer end of the needle shaft and

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secured thereto, said bushing having an outwardly opening passage in communication with said central passageway, a stylet assembly comprising a rod temporarily receivable in said passageway in a position blocking said opening and a handle having a tapered portion temporarily receivable in said pocket, and a collar having a sliding fit on said needle shaft, a tightening screw on said collar, and a pair of laterally extending fingerholds on said collar.

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